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EXAMINER	
HE, AMY	

ART UNIT	PAPER NUMBER
2858	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/521,736	FEUCHT ET AL.	
	Examiner	Art Unit	
	Amy He	2858	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 September 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2 and 4-23* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2 and 4-23* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *19 January 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. Claims 1-2, 4-5, 8-10, 13, 15-16, 18, 22-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Potyrailo et al. (U. S. Patent No. 6, 684,683) in view of Hager et al. (U. S. Patent No. 4, 783,987) and Eda et al. (U. S. Patent No. 5, 747, 857).

As for claim 1, Potyrailo et al. discloses a device (in Figure 1) for detecting at least one substance of a vapor (vapor 22), having at least one piezo acoustic resonator (14) comprising:

at least one piezoelectric layer (acoustic wave material, such as a quartz crystal; see col. 4, lines 42-43);

an electrode and at lease one further electrode (electrodes deposited onto two opposite sides of the acoustic wave material; see col. 4, lines 41-43) disposed on the piezoelectric layer;

a surface section (surface 20, col. 3, line 1) for sorption of the substance of the vapor;

wherein the piezoelectric layer, the electrodes and the surface section are arranged with respect to one another in such a way that an electrical actuation of the electrodes leads to an oscillation of the resonator at a resonance frequency and the

resonance frequency is dependent on an amount of the substance sorbed on the surface section (col. 4, lines 41-63; col. 3, lines 1-14); and

a layer thickness of the piezoelectric layer is chosen from the range of 0.1um inclusive to 20 um (the thickness of the acoustic wave device is from 10 microns to about 2mm; col. 4, line 20) inclusive and the resonance frequency of the oscillation is chosen from the range of 500 MHz inclusive to 10 GHz inclusive (10GHz to 0.1 Hz; col. 4, lines 12-15);

wherein the oscillation of the resonator is thickness shear mode oscillation (col. 3, lines 13-14 and line 54; col. 4, line 44).

Still referring to claim 1, Potyrailo et al. does not specifically disclose detecting a liquid; and that the piezoelectric layer is a polycrystalline piezoelectric layer.

Hager et al. discloses detecting a liquid sample using a piezo resonator, so as to obtain information about the viscosity and density of the liquid (col. 1, lines 39-43; col. 8, lines 59-60 and lines 66-68).

Eda et al. discloses using piezoelectric layer that are advantageously formed by sputtering to obtain a polycrystalline piezoelectric layer, for the purpose of achieving high frequency above 1 GHz (see col. 5, lines 50-55 and col. 6, lines 66-67).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify Potyrailo et al. to use the detecting device to detect liquid samples of interest, as taught by Hager et al., for the purpose of obtaining a real-time characterization of the liquid samples (see Potyrailo et al. reference, col. 1, lines 50-53; Hager et al. reference, col. 1, lines 39-43; col. 8, lines 59-60 and lines 66-68).

Furthermore, the person of ordinary skill in the art would also find it obvious to use a polycrystalline piezoelectric layer advantageously formed by sputtering, as taught by Eda et al., for the purpose of achieving high frequency above 1 GHz(see col. 5, lines 50-55 and col. 6, lines 66-67).

As for claim 2, Potyrailo et al. discloses that the resonator (14) has a lateral extension, which is chosen from the range of 20 um inclusive to 1000 um inclusive (i.e. the length of the acoustic wave device 14 is from 0.2 mm to 50mm, see col. 4, lines 18-19).

As for claim 4, Potyrailo et al. discloses that the piezoelectric layer uses aluminum nitride as the piezoelectric material (col. 4, line 57).

As for claim 5, Potyrailo et al. discloses that the resonator (14) is disposed on a semiconductor substrate (106 in Figure 7, col. 6, line 14).

As for claims 8 and 10, Potyrailo et al. discloses at least one external evaluation device disposed outside of the semiconductor substrate for determining the resonance frequency of the resonator (col. 4, lines 59-63).

As for claim 9, Potyrailo et al. in view of Hager et al. and Eda et al. discloses the device as claimed in 8 as discussed above. Potyrailo et al. in view of Hager et al. and Eda et al. does not specifically disclose that the evaluation device is an internal evaluation device disposed or integrated in the semiconductor substrate. Since it has been held "that the use of a one piece construction instead of the structure disclosed (in the prior art) would be merely a matter of obvious engineering choice." *In re Larson*, 340 F.2d 965, 968, 144 USPQ 347, 349 (CCPA 1965). A person of ordinary skill in the art

would find it obvious at the time the invention was made to modify Potyrailo et al. in view of Hager et al. and Eda et al. to integrate the evaluation device into the semiconductor substrate of the resonator, for the purpose of obtaining a more compact design of the resonator.

As for claim 13, Potyrailo et al. discloses that the surface (20) for sorption of the substance is formed by a chemically sensitive coating of the resonator (coating 18, col. 3, line 2).

As for claims 15-16, Potyrailo et al. discloses a plurality of resonators, combined to form a resonator array and each of the resonators forms an array element of the resonator array, each of the resonators in the resonator array serves to detect a specific substance (col. 3, lines 23-28).

As for claim 18, Potyrailo et al. discloses a method for detecting at least one substance of a vapor (vapor 22) using a device as in claim 1, comprising:

bring the vapor (vapor 22) and the piezo acoustic resonator (14) into contact in such a way that the substance can be sorbed on the surface section (surface 20) of the resonator(14), and determining a resonance frequency of the resonator, whereby the amount of the substance sorbed on the surface section can be deduced from the resonance frequency (col. 4, lines 41-54; col. 3, lines 1-14).

Still referring to claim 18, Potyrailo et al. does not specifically disclose detecting a liquid by bringing the liquid and the piezo acoustic resonator into contact; and that the piezoelectric layer is a polycrystalline piezoelectric layer.

Hager et al. discloses a method of detecting a liquid sample by bringing a liquid into contact with a piezo resonator, so as to obtain information about the viscosity and density of the liquid (col. 1, lines 39-43; col. 8, lines 59-60 and lines 66-68).

Eda et al. discloses using piezoelectric layer that are advantageously formed by sputtering to obtain a polycrystalline piezoelectric layer, for the purpose of achieving high frequency above 1 GHz (see col. 5, lines 50-55 and col. 6, lines 66-67).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify Potyrailo et al. to detect liquid samples of interest by bringing a liquid into contact with a piezo resonator, as taught by Hager et al., for the purpose of obtaining a real-time characterization of the liquid samples (see Potyrailo et al. reference, col. 1, lines 50-53; Hager et al. reference, col. 1, lines 39-43; col. 8, lines 59-60 and lines 66-68).

Furthermore, the person of ordinary skill in the art would also find it obvious to use a polycrystalline piezoelectric layer advantageously formed by sputtering, as taught by Eda et al., for the purpose of achieving high frequency above 1 GHz(see col. 5, lines 50-55 and col. 6, lines 66-67).

As for claim 22, Potyrailo et al. discloses that the chemically sensitive coating (coating 18) has molecules (organic material, or polymers with additives, or variety of gels, col. 9, lines 3-20) for detecting the substance.

As for claim 23, Potyrailo et al. discloses that the chemically sensitive coating (coating 18) has an immobilization layer (cross linking agents, col. 9, lines 48-56)for connecting the resonator and the molecules for detecting the substance.

2. Claims 6 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Potyrailo et al. (U. S. Patent No. 6, 684,683) in view of Hager et al. (U. S. Patent No. 4, 783,987) and Eda et al. (U. S. Patent No. 5, 747, 857), and further in view of Kobrin et al. (U. S. Patent No. 5, 935,150).

As for claim 6, Potyrailo et al. in view of Hager et al. and Eda et al. discloses the device as claimed in claim 5 as discussed above. Potyrailo et al. in view of Hager et al. and Eda et al. does not specifically disclose that at least one device is present to provide acoustic insulation of the resonator and the semiconductor substrate.

Kobrin et al. discloses one device (acoustic isolator 10) is present to provide acoustic insulation of the resonator and the semiconductor substrate, for the purpose of allowing the resonator to resonate freely without damping from loss of acoustic energy to the substrate or the environment while providing solid mechanical support (col. 4, lines 56-67).

A person of ordinary skill in the art would find it obvious at the time the invention was made to further modify Potyrailo et al. to use an acoustic isolator to provide acoustic insulation of the resonator and the semiconductor substrate, as taught by Kobrin et al., for the purpose of allowing the resonator to resonate freely without damping from loss of acoustic energy to the substrate or the environment while providing solid mechanical support (col. 4, lines 56-67).

As for claim 14, Potyrailo et al. in view of Hager et al. and Eda et al. discloses the device as claimed in 13. Potyrailo et al. in view of Hager et al. and Eda et al. does not

specifically disclose that the resonator has a protective layer (13) and the chemically sensitive coating (18) is applied to the protective layer.

Kobrin et al. disclose the use of a protective layer (13) and that a chemically sensitive coating (6) is applied to the protective layer, for the purpose of providing temperature compensations (col. 3, lines 62-63).

A person of ordinary skill in the art would find it obvious at the time the invention was made to further modify Potyrailo et al. to use a protective layer so that the chemically sensitive coating (18) is applied to the protective layer, as taught by Kobrin et al., for the purpose of providing temperature compensations (col. 3, lines 62-63).

3. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Potyrailo et al. (U. S. Patent No. 6, 684,683) in view of Hager et al. (U. S. Patent No. 4, 783,987) and Eda et al. (U. S. Patent No. 5, 747, 857), and further in view of Hirama et al. (U. S. Patent No. 4, 870, 313).

As for claim 7, Potyrailo et al. in view of Hager et al. and Eda et al. discloses the device as in claim 5. Potyrailo et al. in view of Hager et al. and Eda et al. does not specifically disclose that the surface section (20) for sorption of the substance of the liquid is disposed at a recess of the semiconductor substrate.

Hirama et al. disclose a surface section disposed at a recess of the semiconductor substrate, for the purpose of utilizing the characteristic in a vibration energy trapping mode of a higher order symmetric or asymmetric mode vibration of the piezoelectric resonator (col. 3, lines 6-15).

A person of ordinary skill in the art would find it obvious at the time the invention was made to further modify Potyrailo et al. to dispose the sorption surface section at a recess of the semiconductor substrate, as taught by Hirama et al., for the purpose of utilizing the characteristic in a vibration energy trapping mode of a higher order symmetric or asymmetric mode vibration of the piezoelectric resonator (col. 2, lines 36-39).

4. Claims 11-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Potyrailo et al. (U. S. Patent No. 6, 684,683) in view of Hager et al. (U. S. Patent No. 4, 783,987) and Eda et al. (U. S. Patent No. 5, 747, 857), and further in view of Chang et al. (U. S. Pat. No. 6, 607, 934).

As for claims 11-12, Potyrailo et al. in view of Hager et al. and Eda et al. discloses the device as in claim 10. Potyrailo et al. in view of Hager et al. and Eda et al. does not specifically disclose the device for establishing electric contact between the resonator and the external evaluation device is a high frequency substrate selected from FR4 substrate and LTCC substrate, and that a flip-chip technology is used.

Chang et al. disclose the use of LTCC and flip-chip technology for obtaining a lower dielectric attenuation and for cost-saving purposes (col. 6, lines 6-30).

A person of ordinary skill in the art would find it obvious at the time the invention was made to further modify Potyrailo et al. to disclose that the device for establishing electric contact between the resonator and the external evaluation device is a high frequency substrate or LTCC substrate, and that a flip-chip technology is used, as

taught by Chang et al., for the purpose of obtaining a lower dielectric attenuation and for cost-saving purposes (col. 6, lines 6-30).

5. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Potyrailo et al. (U. S. Patent No. 6, 684,683) in view of Hager et al. (U. S. Patent No. 4, 783,987) and Eda et al. (U. S. Patent No. 5, 747, 857), and further in view of Baer et al. (U. S. Patent No. 5, 130, 257).

As for claim 17, Potyrailo et al. in view of Hager et al. and Eda et al. discloses the device as in claim 15. Potyrailo et al. in view of Hager et al. and Eda et al. does not specifically disclose that the spacing between adjacent array elements is chosen from the range of 50 um inclusive to 1000 um inclusive.

Baer et al. disclose that a spacing between adjacent array is chosen from a range of 50um inclusive to 1000 um inclusive (1-100 micron, col. 4, line 41).

A person of ordinary skill in the art would find it obvious at the time the invention was made to further modify Potyrailo et al. to disclose a spacing between adjacent array is chosen from a range of 50 um to 1000 um, as taught by Baer et al., for the purpose of reducing the overall size of the resonator array, and since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F. 2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

6. Claims 19-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Potyrailo et al. (U. S. Patent No. 6, 684,683) in view of Hager et al. (U. S. Patent No. 4, 783,987) and Eda et al. (U. S. Patent No. 5, 747, 857), and further in view of Zhang et al. (U. S. Pub. No. 2005/0148065).

As for claims 19-21 Potyrailo et al. in view of Hager et al. and Eda et al. discloses the method as in claim 18. Potyrailo et al. in view of Hager et al. and Eda et al. does not specifically disclose that the resonance frequency is determined in the presence of the liquid; in the absence of the liquid; or that after the liquid and the resonator are brought into contact and before the resonance frequency is determined the liquid is removed in such a way that the substance remains sorbed on the surface section of the resonator.

Zhang et al. disclose determining the frequency response in the presence of the liquid (i.e., when only a portion of the fluid is removed, some fluid is still present when frequency response is determined, see claim 29); in the absence of the liquid (i.e., when all fluid is removed as in claim 30); and after the liquid and the resonator are brought into contact and before the resonance frequency is determined the liquid is removed in such a way that the substance remains sorbed on the surface section of the resonator (claim 30), for the advantage of greater detection sensitivity and faster response time and the ability to perform detection of target molecules during or after exposure to wet environments (see [0057] and [0037]).

A person of ordinary skill in the art would find it obvious at the time the invention was made to further modify Potyrailo et al. to determine the resonance frequency in the presence of the liquid or in the absence of the liquid; or after the liquid and the resonator

are brought into contact and before the resonance frequency is determined, to remove the liquid in such a way that the substance remains sorbed on the surface section of the resonator, as taught by Zhang et al., for the purpose of obtaining greater detection sensitivity and faster response time and the ability to perform detection of target molecules during or after exposure to wet environments (see [0057] and [0037]).

Response to Arguments

7. Applicant's arguments filed September 04, 2007 have been fully considered but they are not persuasive.

In response to applicant's argument that Neither Potyrailo and Hager references discloses operation in the thickness shear mode in a range from 500 MHz to 10 GHz, applicant's attention is directed specifically to the Potyrailo reference, on col. 4, lines 12-15, and col. 3, lines 13-14, and col. 4, line 44, wherein the passages recite that the operation frequency ranges from 10GHz to 0.1 Hz and the oscillation is in the thickness-shear mode.

In response to applicant's argument that there is no suggestion to combine the references based on the different techniques used by the Potyrailo and Hager references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in

the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992).

In this case, Potyrailo teaches every limitation as in claim 1, except for detecting a liquid; and that the piezoelectric layer is a polycrystalline piezoelectric layer.

Hager et al. discloses detecting a liquid sample using a piezo resonator, so as to obtain information about the viscosity and density of the liquid (col. 1, lines 39-43; col. 8, lines 59-60 and lines 66-68).

Eda et al. discloses using piezoelectric layer that are advantageously formed by sputtering to obtain a polycrystalline piezoelectric layer, for the purpose of achieving high frequency above 1 GHz (see col. 5, lines 50-55 and col. 6, lines 66-67).

Potyrailo in view of Hager and Eda et al. would have suggested one of ordinary skill in the art at the time the invention was made to use the same detecting device to detect liquid samples of interest, as taught by Hager et al., for the purpose of obtaining a real-time characterization of the liquid samples (see Potyrailo et al. reference, col. 1, lines 50-53; Hager et al. reference, col. 1, lines 39-43; col. 8, lines 59-60 and lines 66-68). Moreover, the person of ordinary skill in the art would also find it obvious to use a polycrystalline piezoelectric layer advantageously formed by sputtering, as taught by Eda et al., for the purpose of achieving high frequency above 1 GHz(see col. 5, lines 50-55 and col. 6, lines 66-67).

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Amy He whose telephone number is (571) 272-2230. The examiner can normally be reached on 8:30am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Andrew Hirshfeld can be reached on 571-272-2168. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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